GRASSELLI

CHROMATED ZINC CHLORIDE

AN IMPROVED WOOD PRESERVATIVE
FOR PERMANENT CONSTRUCTION

DEPENDABLE PROTECTION *against* DECAY AND TERMITES

See page 19

Clean · Odorless · Paintable · Fire Retardant

Digitized by the Internet Archive
in 2024 with funding from
Columbia University Libraries

https://archive.org/details/chromatedzincchl00gras

CHROMATED ZINC CHLORIDE

• • • AN IMPROVED WOOD PRESERVATIVE FOR PERMANENT CONSTRUCTION • • •

•

DEPENDABLE PROTECTION AGAINST DECAY AND TERMITES

•

CLEAN, ODORLESS, PAINTABLE, FIRE RETARDANT

E. I. DU PONT DE NEMOURS & CO., INC.
GRASSELLI CHEMICALS DEPARTMENT
Wilmington, Delaware

Copyright 1936
By

E. I. DU PONT
DE NEMOURS & CO.,
INC.

Wilmington, Delaware

CONTENTS

PAGE

Foreword 5
Selection of a Standard Preservative 6
Chromated Zinc Chloride — an improved form of zinc chloride 6
Attributes of Chromated Zinc Chloride 6
Why should treated lumber be used? 6-7
What does treatment cost? 7
Selection of lumber for treatment 7-8
Selection of treating process 8
How does preservation aid the architect and engineer? 8
Strength of treated lumber 9
What is decay — How is it prevented? 9
Termites — an economical method to combat them 10-11
Preservative value of Chromated Zinc Chloride . . 12
Paintability 12
Fire Retardance 13
Leaching 14
Surface Hardness 15
Non-corrosive to hardware 15
Fabricating lumber treated with Chromated Zinc Chloride 15
Health hazards 15
Penetration of treating reagent 15-16
Economy of wood preservation 16-17

A Few of the Many Uses Suited to Chromated Zinc Chloride Treated Lumber

Railroads 17
Mines 18
Industrial construction 18
Marine structures 19
Highways 19
Commercial buildings 20
Farm buildings 20
Recreational structures 21
Treatment for the home 21-23
Specifications for Chromated Zinc Chloride pressure treatment 24-25
Miscellaneous 25

FOREWORD

APART from all other considerations the economic value of a wood preservative must be judged by its period of usefulness in service. Other beneficial attributes are desirable but resistance to decay and termite attack rank foremost. On this broad aspect the Wood Preserving Industry has developed a high standard of skill and scientific technique confirmed in practice by years of accomplishment and measured in terms of indisputable "service".

No construction material is actually perfect. Concrete disintegrates under usage. Steel deteriorates from corrosion. Wood, inherently the most versatile is subject to decay and insect attack. Despite these obvious shortcomings wood possesses distinctive properties unequaled by any other form of material. Among these are resiliency, strength, low heat conductivity, ease of fabrication and maintenance, availability and low initial cost. Proper preservation reduces its inflammability and effectively overcomes its other forms of premature destruction.

FACTS ON WOOD PRESERVATION

Selection of a Standard Preservative

Chemical Wood Preservation may be categorically divided into two groups, one requiring a clean, odorless, paintable treatment, the other for uses where the discoloration, odor or inflammability of Creosote Oil are not objectionable. The American Wood Preservers' Association and other commercial associations as well as the several divisions of the Federal Government have long since provided for both forms in their specifications, Zinc Chloride serving as the "standard" salt reagent for "clean" treatment and Creosote Oil where its properties are desired. This broad recognition of Zinc Chloride is predicated upon actual usage for nearly one hundred years and by service records antedating the compilation of such statistics. During the past seven years only, more than two billion b.m.f. of lumber and timber were treated with Zinc Chloride representing approximately 93% of all "clean" treatment produced.

Chromated Zinc Chloride — An Improved Form of Zinc Chloride

The long established Zinc Chloride treatment is now available commercially in an improved form identified as GRASSELLI CHROMATED ZINC CHLORIDE. This improved product is the result of extended research undertaken in collaboration with members of the wood treating industry and embracing wood preservation in its entirety. Accurate estimations by the various means known to science qualify its introduction as a distinct improvement over any salt treatment known heretofore and as an outstanding preservative capable of rendering unequaled service for any need warranting this form of treatment. GRASSELLI CHROMATED ZINC CHLORIDE is not a new reagent but one yielding the user the long established Zinc Chloride treatment in an improved form. The inherent properties of Zinc Chloride are retained, but augmented with a compatible product of known utility, greatly increased durability and permanence are obtained. GRASSELLI CHROMATED ZINC CHLORIDE is not a patented proprietary compound but merely a formulation of commercial chemicals available to the treating industry without license.

Attributes of Chromated Zinc Chloride

CHROMATED ZINC CHLORIDE treatment will improve the physical and mechanical properties of lumber in many ways. It provides characteristics lending themselves to widely diversified types of service. Improvement resulting from this form of treatment include:

- Decay resistance
- Termite repellence
- Fire retardance
- Clean
- Odorless
- Paintable
- Improved surface hardness
- Increased resistance to abrasion
- Free from harmful poisonous compounds
- Non-corrosive to hardware
- Readily fabricated
- Economical

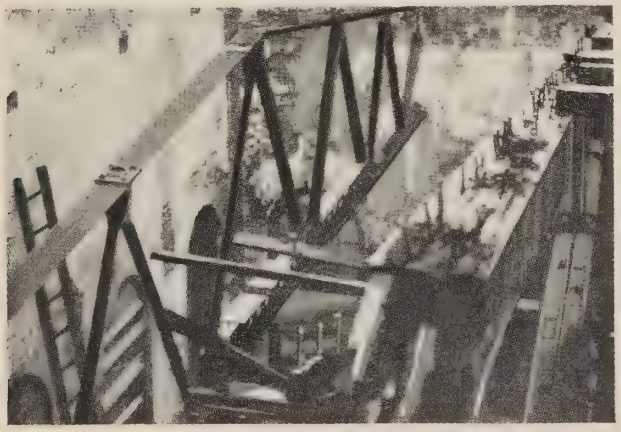
Various of these properties will be described separately in the following pages of this book.

Why Should Treated Lumber be Used?

Partially decayed lumber is dangerous. Nail holding power is destroyed, resistance to wind storms is reduced, load bearing strength is impaired and inflammability greatly increased.

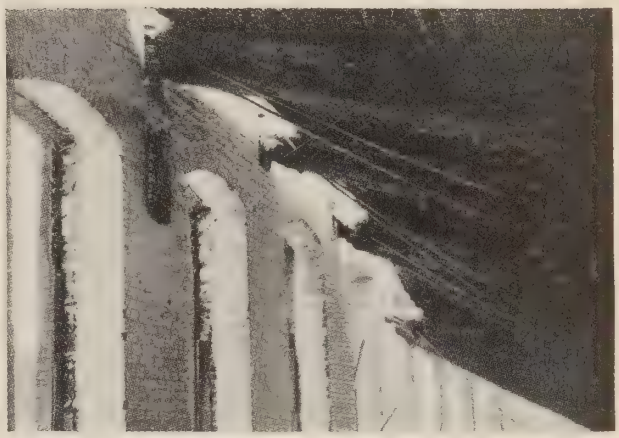
Termite infested lumber is structurally weak and unsafe. Superficial "after" treatments are costly, of limited utility and powerless to correct damage already present.

Lumber impregnated with CHROMATED ZINC CHLORIDE retains its full strength indefinitely, is immune to early destruction from natural causes and capable of long-time service under the most severe conditions.



★ WEAKENED BY DECAY

The 3-inch roof planks were substantially spiked but had rotted, and therefore easily tore away when the wind lifted the roof. The spikes in the nailing pieces can be seen at the right.



★ FIRE HAZARD OF DECAYED WOOD

The floor shown in shadow in the upper right was not deeply burned but the rotted ends of the beams quickly burned off allowing the floor to drop.

★ ROOF PLANKS ROTTED OVER BEAM

Note how the ends of the roof plank are rotted over the supporting beam. The rot has also extended three or four inches down into the beam.

What Does Treatment Cost?

The committee on Wood Utilization of the U. S. Department of Commerce choosing a typical home for the purpose of comparison, estimate that at an added cost of but 2% all vulnerable parts of a new home can be permanently protected against premature decay and termite attack using properly treated lumber. No item of cost entering into the construction of a permanent building is more justly warranted. Treated lumber for repairs and replacements is also very economical.

Selection of Lumber for Treatment

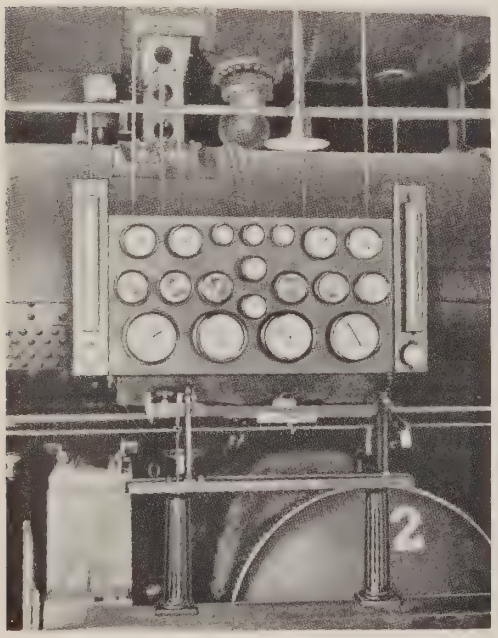
Naturally durable timber is costly and no longer plentiful. The cheaper abundant species now in common use are admittedly less resistant to decay and termite attack yet possess excellent mechanical strength and absorb preservatives readily. In a properly treated condition they are vastly superior to untreated installations of those alleged to be more durable. Engineers preparing specifications for treated lumber are encouraged to waive high heartwood requirements and to select grades reflecting

★ Photo courtesy Associated Factory Mutual Fire Insurance Companies.

the greatest economy. The selection of lumber and structural timber by species and heart content and its reputation for strength and durability untreated, without regard to the grade and the serviceability of treated wood, may often result in the purchase of more expensive timber than is warranted or impose shipments from long distances when more suitable timber is available from a nearer source.

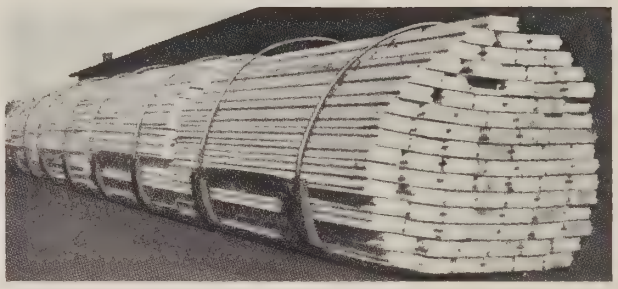
Selection of Treating Process

To obtain the maximum utility from treated lumber, the reagent must be thoroughly impregnated into the wood. Pressure impregnation is the most effective. Adherence to Specification No. 35C of the American Wood Preservers' Association will assure the user of properly treated lumber. Specifications for CHROMATED ZINC CHLORIDE treatment shall contain provisions for impregnating "not less than ¾ lb. of dry salt per cubic foot" of wood. Complete specifications applicable to vacuum-pressure treatment for CHROMATED ZINC CHLORIDE will be found on page 24 of this book.



Interior view of modern wood preserving plant. Accurate measurements assure purchaser of well treated lumber.

★ Photo courtesy Associated Factory Mutual Fire Insurance Companies.



Zinc Chloride Treated Lumber at a commercial treating plant.

How Does Preservation Aid the Architect and Engineer?

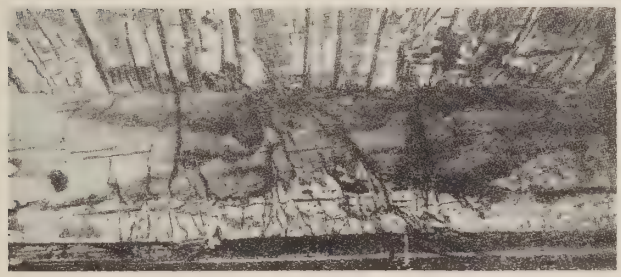
The use of preserved lumber and timber for any construction need requiring safe load bearing strength will enable engineers to design structures for the actual loads and stresses involved without resort to oversized dimensions and liberal safety factors in anticipation of weakening from decay. Similarly, it will assure the receipt of sound, carefully selected and properly handled lumber free from defects occasioned by careless handling as illustrated in the accompanying photograph. Preservation also makes available the cheaper less naturally durable grades of lumber broadening the available sources of supply and reflecting economies of substantial proportions. It is dangerous to depend upon the strength of untreated timbers.

★ FUNGUS IN A LUMBER PILE

The adjacent surfaces of these two planks from a pile of closely stacked lumber were found almost covered with lacelike fungus when the planks were separated. Proper piling with separating sticks and adequate ventilation will prevent such a condition.

Strength of Treated Lumber

Extended studies by various authorities prove that lumber treated in an approved manner suffers no loss of strength from the treating cycle. Excessively high temperatures or pressures applied by careless or inexperienced operators can cause weakening however, the standard reagents such as zinc chloride or creosote oil do not contribute to any reduction. Adherence to the carefully controlled specifications of the American Wood Preservers' Association will assure the user of a treatment strictly in accordance with the requirements prescribed and common to the specie of wood involved. In the preparation of plans and specifications for treated lumber the same working stresses applicable to untreated lumber of similar dimension may be applied. Properly treated lumber possesses no disadvantages. The attributes are in its favor.



★ FUNGUS IN AN UNVENTILATED MILL BASEMENT

View of a 12″ x 16″ yellow pine beam and 4-inch spruce floor plank readily rotted in five years by fungus in the moist basement of a woolen mill in Massachusetts.

What is Decay? How is it Prevented?

Decay, sometimes called "dry rot" or "wet rot", is caused by a living organism known as fungi. It is a low parasitic form of plant life. The sustenance and propagation of rot producing fungi requires air, moisture, food and favorable temperatures. Obviously it is not practical to exclude air, the moisture of the atmosphere or to control temperatures favorable to fungi development but by impregnating the wood with antiseptic chemicals toxic to fungi and of which CHROMATED ZINC CHLORIDE is outstanding, it is rendered unfit as a source of food making attack uninviting. When wood remains untreated and is subject to uses favorable to fungi development prolific spores germinate rapidly sending threadlike filaments throughout its structure. Often the presence of living fungi is not visible on the surface and is not known until failure occurs. The filaments spreading throughout the wood rapidly cause loss of strength by a process of destruction which ultimately leaves the wood in a "crumbly" condition, and of little load bearing or fire resisting value. Impregnation with suitable chemicals is the only practical method known to protect against this form of destruction. The natural decay resistance present in all common species of wood is confined to the heartwood. Cost and lack of availability would mitigate against any extended use of all heartwood. The sapwood content, untreated, has low resistance to decay and is not serviceable under conditions of use favorable to fungi development. Treatment with Chromated Zinc Chloride will impart substantial durability to all species of sapwood and yield a service life exceeding the better naturally durable varieties.

Untreated framed timbers in storage showing fungus attack. Metal mine in Michigan.

★ Photo courtesy Associated Factory Mutual Fire Insurance Companies.

TERMITES

An Economical Method to Combat Them

Damage by termites (white ants) is growing at an alarming rate. No section of the United States is immune to their attack. Few species of wood offer resistance to them unless properly treated with repellent antiseptic chemicals. Two types of destructive termites exist in this country, the subterranean or ground burrowing variety and the flying species. The former are more widespread and command principal attention. Termites are not new or rapacious insects imported from the Tropics but have been present in this country for centuries. As forests are becoming depleted they are deprived of their natural habitats and consequently seek other sources of wood for food and shelter. Government Bureaus and responsible technical associations have made extended studies of their habits and means to obviate their damage. The diagram on page 11 reveals the subterranean species method of approach, the damage resulting from their presence and what may be done to prevent their progress. Subterranean termites shun light and hidden from view confine their activities to the inner parts or core of the wood affected. Obviously surface treatments are ineffective for long-time protection while volatile products scarcely warrant the cost of their application. Soil poisons are also short-lived with the added disadvantage of destroying plant

★ UNTREATED OAK FLOORING DAMAGED BY TERMITES

Above, upper surface; below, under side.

Close view of Termite Test House at Barro Colorado Island, Panama Canal Zone.

Resting on Creosote supports. Building proper treated with Zinc Chloride. No evidence of penetration after ten years' exposure. Untreated wood in this area destroyed in less than one year.

Note tropical conditions ideal for propagation of termites and fungi.

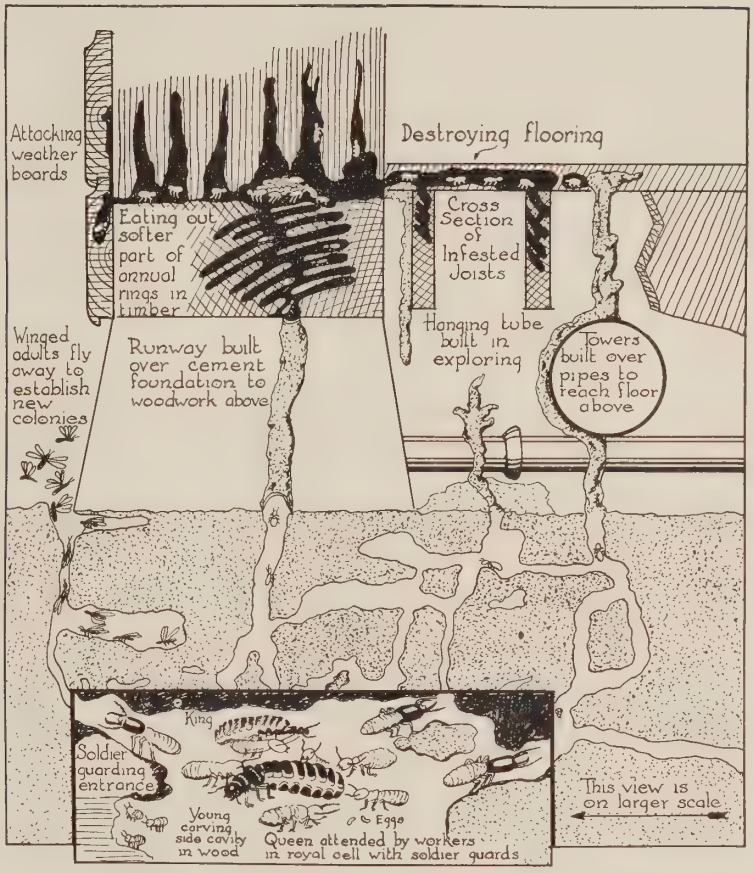
An Example of Termite Damage at Butt of Untreated Pole.

(Illustration by Courtesy National Electric Light Association).

The accompanying view shows clearly the damage which termites are capable of doing to an untreated pole. Recent experience is demonstrating, moreover, that termite attack is not confined to the butt alone, but that it may occur all the way from the ground line to the top. Proper treatment will prevent such destruction.

★ Photo courtesy Dr. T. E. Snyder, U. S. Bureau of Entomology and Plant Quarantine.

DIAGRAM ILLUSTRATING METHOD OF ATTACK COMMON TO SUBTERRANEAN TERMITE


Attacking weather boards
Destroying flooring
Eating out softer part of annual rings in timber
Cross Section of Infested Joists
Hanging tube built in exploring
Towers built over pipes to reach floor above
Winged adults fly away to establish new colonies
Runway built over cement foundation to woodwork above
King
Soldier guarding entrance
This view is on larger scale
Young carving side cavity in wood
Eggs
Queen attended by workers in royal cell with soldier guards

Courtesy University of California Agricultural Experiment Station

growth. It is fundamental that acceptable termite repellent treatments must be both safe and permanent. Bankers and realty operators financing home construction over long loan periods and who recognize the burden or probable default of the purchaser in the event of early serious damage are becoming increasingly interested in the value of treated lumber as a form of insurance to safeguard their investment. Many already impose it as an obligatory provision before a project is considered eligible for a loan. As the importance of this problem becomes more fully recognized, in all likelihood buildings erected with the view of preventing termite damage will warrant larger loans or lower interest rates than similar unprotected buildings. The slight initial cost properly treated lumber imposes will save a considerable sum in relatively few years. It is difficult and expensive to rid a building of termites and to repair the damage they have done but foresight in advance of construction will overcome this source of expense. It is uneconomical to speculate with other than approved treating reagents. Lumber impregnated with CHROMATED ZINC CHLORIDE may be depended upon to furnish excellent protection.

Preservative Value of Chromated Zinc Chloride

It is axiomatic that a good wood preservative must possess several inter-related properties including:

(1) High initial toxicity to wood-destroying fungi.

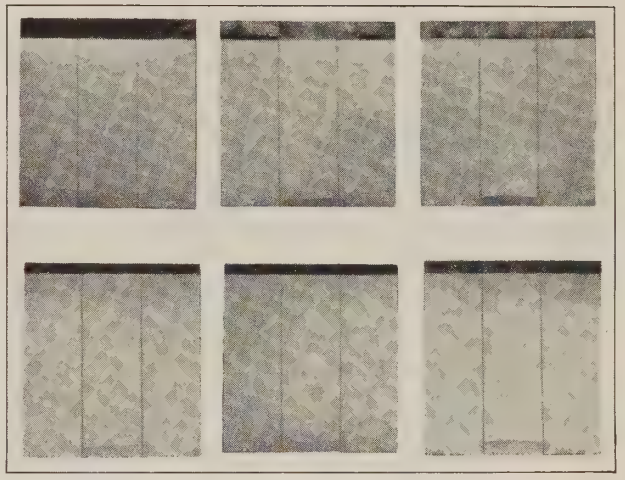
(2) Physical permanence of preservative in the wood.

(3) Retention of toxicity by the preservative.

No one to two alone can qualify the value of a commodity as a preservative. As compatible measures, the reagent must not reduce the strength or physical characteristics of the treated wood nor contain ingredients capable of imposing health hazards to those exposed to it. Similarly, it must be economical and available to the entire wood-treating industry.

To accurately evaluate these fundamental requirements, studies too lengthy to summarize in this publication have been made. Interested engineers and architects will however, be supplied with technical details describing the scope, purpose and results of these tests upon request.

The initial toxicities of zinc chloride and sodium dichromate, components of CHROMATED ZINC CHLORIDE have long been established by the Forest Products Laboratory. The actual usefulness of zinc chloride alone was already supported by service records of many years and required no specific study. To determine the potential usefulness of these products in a compatible formulation opened new fields of research embracing leaching studies, wood block tests, including direct exposure to carefully cultivated cultures of wood-destroying fungi and actual outdoor service tests under relative conditions. Reduced to their essentials, these varied studies indicate greater retention of toxic salts employing CHROMATED ZINC CHLORIDE in direct comparison with all other "salt" reagents investigated, immunity to fungus attack under controlled conditions and outstanding resistance to decay under actual outdoor service conditions. The preservative value relationship exhibited employing a standard 8 lb. treatment of No. 1 AREA Creosote Oil for comparison reveals CHROMATED ZINC CHLORIDE almost comparable with the Creosote Oil treatment, and unaltered Zinc Chloride, following next in order. CHROMATED ZINC CHLORIDE is proving infinitely better than all other "salt" reagents included in these tests.



TREATED AND UNTREATED WOOD PAINTED

In each row, the left-hand panel was made of untreated wood, the middle panel of wood treated with 1.5 lb. per cu. ft. of zinc chloride, and the right-hand panel with a mixture of 1 lb. of zinc chloride and 0.5 lb. of sodium dichromate per cu. ft. Exposed 26 months under test conditions when photographed.

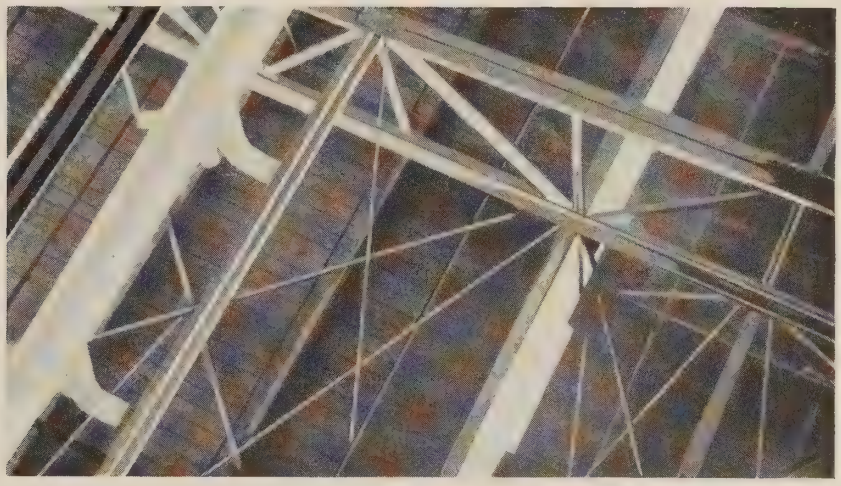
Paintability

Studies by the Forest Products Laboratory of Madison, Wisconsin (see AWPA Proceedings 1934), dealing with the paintability of treated lumber may be summarized by the following excerpt from their report.

> "On the panels treated with a mixture of zinc chloride and sodium dichromate, the coatings usually lasted fully as long as they did on the corresponding untreated panels and often longer. This statement applies whether durability is judged on the basis of integrity alone or on protection as well as integrity. The mixture of zinc chloride and sodium dichromate is economical and practicable for use in wood preserving plants that now use zinc chloride."

The paintability of lumber treated with zinc chloride formulations is amply confirmed by many installations in service including paper and textile mill roofs exposed to abnormally high humidities, highway posts and guardrail and varied outdoor exposures.

Treated lumber should be thoroughly seasoned or kiln dried before paint is applied.



Zinc Chloride Treated Roof Timbers in Paper Mill.

Fire Retardance

The fire retardant properties of zinc chloride and other commodities useful for this purpose have been accurately studied by the Forest Products Laboratory of Madison, Wisconsin. Diammonium Phosphate recognized as one of the leading fire retardant salts but useless as a wood preservative offers an excellent measure for comparison.

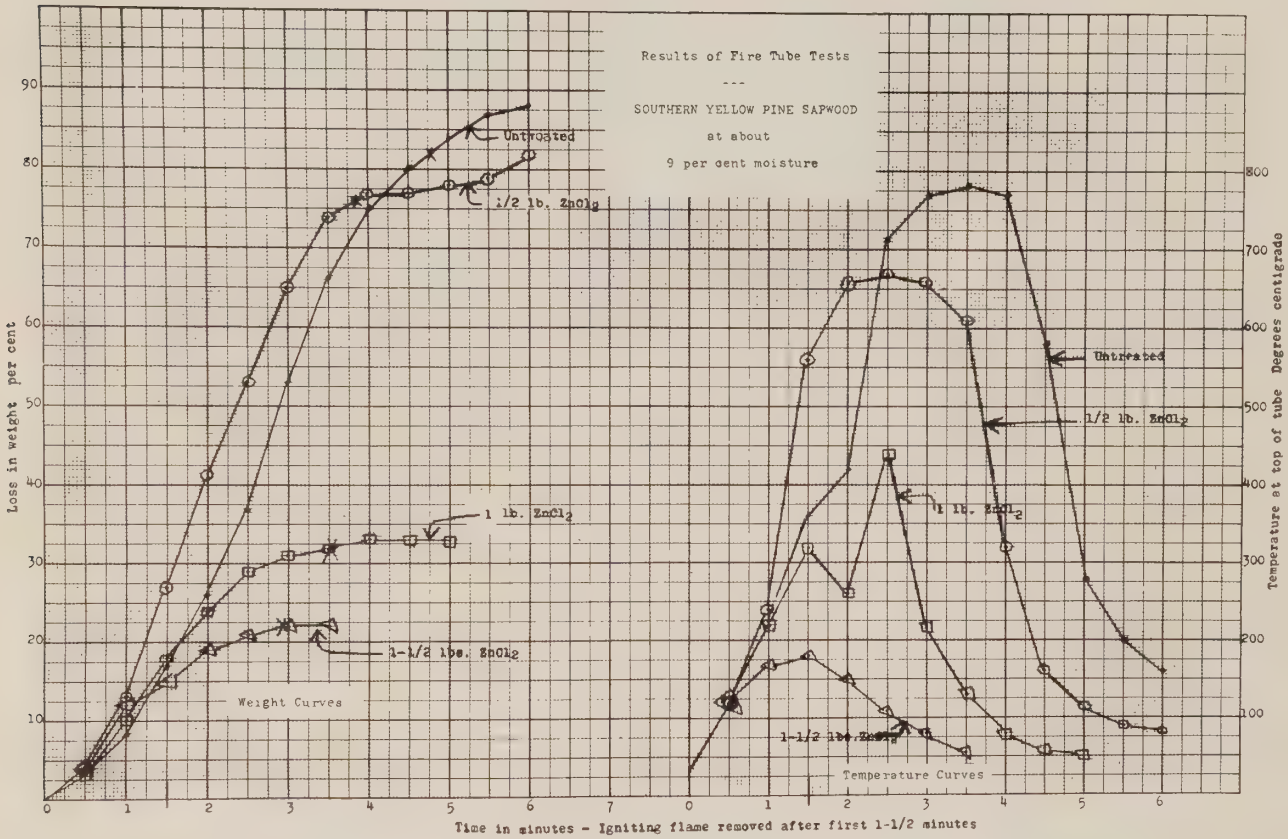
A comparison of zinc chloride and sodium dichromate, the constituents of CHROMATED ZINC CHLORIDE in contrast with Diammonium Phosphate at both high and low retentions as reported by the Forest Products Laboratory is as follows:

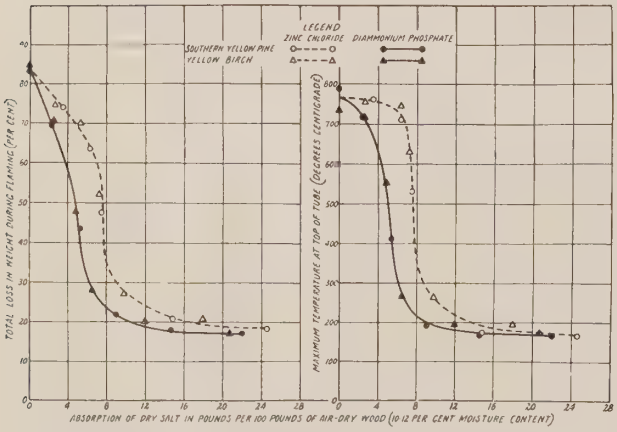
Reagent	Retention Lbs. cu. ft.	Loss in Weight	Max. Temp. Degrees Cent.	Tendency to Glow
Zinc Chloride.....	1.07	63.2%	755	Moderate
	5.97	17.2%	185	Slight
Sodium Dichromate.....	1.40	71.8%	832	Moderate
	6.52	36.0%	304	Slight
Diammonium Phosphate.....	1.16	57.8%	620	None
	5.86	15.0%	166	None

It will be observed that zinc chloride which is the predominating constituent of CHROMATED ZINC CHLORIDE compares favorably with Diammonium Phosphate on a pound for pound basis.

The lower graph on page 14 illustrates their relative value as demonstrated by other tests made by the Forest Products Laboratory. The upper graph demonstrates the influence of various retentions of zinc chloride in comparison with untreated wood.

From this data it is obvious that retentions higher than those ordinarily employed as a preservative are necessary to establish a high degree of fire retardant value. However, the usual preservative treatment of ¾ to 1 pound of Zinc Chloride or CHROMATED ZINC CHLORIDE per cubic foot will leave the lumber in a condition difficult to ignite.




LEGEND
ZINC CHLORIDE
DIAMMONIUM PHOSPHATE
SOUTHERN YELLOW PINE
YELLOW BIRCH
TOTAL LOSS IN WEIGHT DURING FLAMING (PER CENT)
MAXIMUM TEMPERATURE AT TOP OF TUBE (DEGREES CENTIGRADE)
ABSORPTION OF DRY SALT IN POUNDS PER 100 POUNDS OF AIR-DRY WOOD (10 12 PER CENT MOISTURE CONTENT)

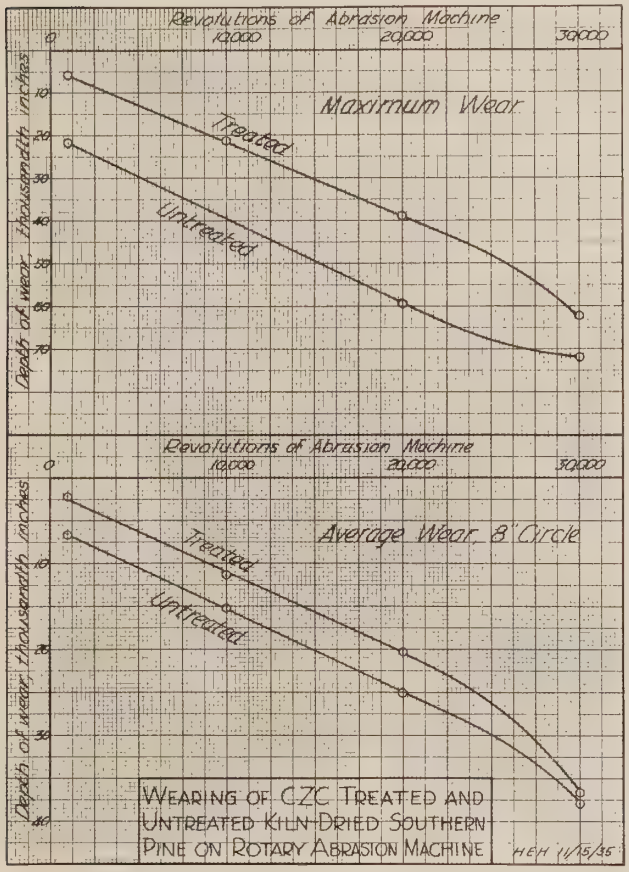
Comparison of diammonium phosphate and zinc chloride as fire retardants. Treated boards dried and surfaced before cutting specimens. Each plotted point represents from 16 to 20 specimens cut from four boards.

Leaching

The leachability of "salt" treating reagents has been made the basis of many hypothetical lines of reasoning. In the main they have been over emphasized and confusing to the engineer. It has been established and it is generally accepted that any effective wood preservative has an appreciable water solubility. It follows that any preservative having value will leach. Some commodities react with themselves or with components of the wood to form compounds having greater resistance to dissolution by water. In any case however, the value of a preservative is not determined by the amount of residual chemicals left in the wood after exposure to the elements, but by the toxicity of the compounds left in the wood. CHROMATED ZINC CHLORIDE will leach sufficiently to saturate the wood with water soluble toxic salts capable of inhibiting fungi growth and development.

Surface Hardness

Improved surface hardness and greater resistance to abrasion are characteristic of lumber treated with CHROMATED ZINC CHLORIDE. These properties adapt it particularly well for uses including loading platforms, warehouse floors and other purposes imposing excessive mechanical wear. Abrasion tests summarized in the accompanying graph indicate substantially higher resistance for the treated panel in contrast with a comparable untreated specimen.



Non-Corrosive to Hardware

Extended studies indicate that nails and hardware attached to properly seasoned treated lumber imposes no more severe corrosion than that obtained on untreated wood.

★ Photo by Mellon Institute.

Fabricating Lumber Treated with Chromated Zinc Chloride

With seasoned or kiln dried CHROMATED ZINC CHLORIDE treated lumber, there is no corrosion of woodworking tools. Similarly it causes no significant reduction in the strength of glued joints, using commercial glues such as casein, starch or animal glue.

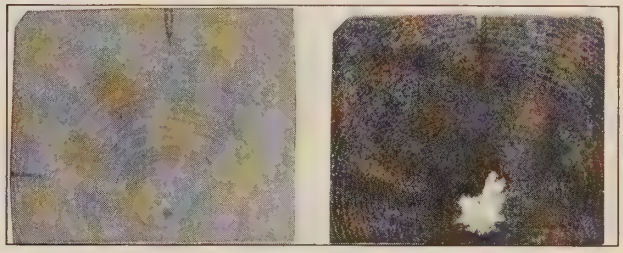
Health Hazards

It is fundamental that wood preserving reagents be effective for the purpose intended but similarly, they must not impose health hazards to those engaged in handling the treated lumber or those exposed to it after installation. CHROMATED ZINC CHLORIDE is free from arsenicals or toxic volatile organic compounds which might be harmful to the human system. CHROMATED ZINC CHLORIDE may be safely used in buildings erected for human habitation or those designed for the storage of foodstuffs.

Penetration of Treating Reagent

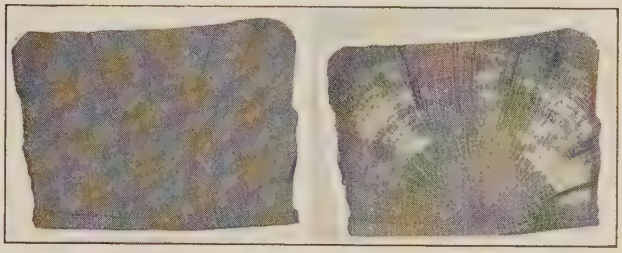
CHROMATED ZINC CHLORIDE lends itself to conventional pressure treating equipment and readily

PINE



Before Spraying — After Spraying

RED OAK



Before Spraying — After Spraying

★ COLOR TEST FOR ZINC CHLORIDE PENETRATION

Cross sections of Zinc Chloride treated pine and red oak mine ties, showing color change when sprayed with potassium iodide-potassium ferricyanide-starch solution. Left column shows cross sections before spraying, right column after spraying.

penetrates treatable wood. Being but a two component mixture it is more readily and accurately impregnated than products of a more complex nature which dissociate and enter the wood at selective rates of absorption. The penetration of CHROMATED ZINC CHLORIDE can be quickly determined by observing the color change resulting from spraying the treated area with a simple chemical solution. An increment borer, which takes out a small core but does not destroy the timber, may also be used. In this case the core is sprayed with the color solution. When measuring the depth of penetration by this method the treated areas rapidly assume a dark blue color while the untreated areas retain the original color of the wood.

The American Wood Preservers' Association have adopted a standard method of test for determining the penetration of zinc chloride which test is also applicable to CHROMATED ZINC CHLORIDE.

Their specification for determining this point reads as follows:

Standard Method for Determining Zinc Chloride Penetration by Color Reaction Test with Iodine-Potassium Ferricyanide Starch

Chemical Principle

The iodine method for determining zinc chloride penetration is based on the principle that zinc ferricyanide liberates free iodine and free iodine in turn gives a dark blue stain with starch solution. It is evident then that the zinc chloride that has been injected into the wood will react with potassium ferricyanide, making zinc ferricyanide, and this in turn will liberate free iodine and give the blue stain as stated above. It is a well-known fact that free iodine can be detected in very minute quantities with starch solution, and can be made a very delicate test, such as detecting minute amounts of zinc chloride in treated wood.

Preparation of Solutions

Prepare about 200 c.c. each of the following stock solutions, to be kept separate until used:

1% solution of potassium ferricyanide.
1% solution of potassium iodide.
5% solution of soluble starch.

In making a starch solution, be sure to boil until the starch is in solution, otherwise the reaction will not be satisfactory. A starch solution will not keep long, and must not be used when it begins to sour. Be sure the starch solution is reasonably fresh.

Method of Application

The disc of wood to be tested should be reasonably dry. Mix 10 c.c. each of the 3 stock solutions, and pour into a good atomizer. A De Vilbiss No. 30 has been found satisfactory. Spray the disc of wood evenly all over. The reaction between the zinc chloride and the spraying solution will instantly cause the treated wood to turn a deep blue, while the untreated part will retain its original color. This method is a positive test. Should the color fade, repeat the process.

A. Borings from Zinc Chloride Treated Timbers in mine after 24 years' service when sprayed to determine presence of toxic Zinc Chloride.

B. Untreated borings showing no reaction.

Chemical analysis of specimens "**A**" shows sufficient Zinc Chloride still present to afford many additional years of protection.

See "Wood Preserving News," April, 1932.

Economy of Wood Preservation

Since railroads are the principle consumers of preserved timber they similarly present the best illustration of the economies treatment accomplishes. Cross tie service records recently reported by one of the principal railroads reveal a service life for untreated ties upward from 2.9 years and an overall average of but 5.6 years for all species investigated. In contrast, treated ties with service already in excess of 20 years have not outlived their usefulness. It is predicted that mechanical wear will contribute more to their ultimate destruction than decay.

Mine ties and timbers also show quick returns to the user of treated timber. Conditions conducive to decay are favorable in all undergound workings and

timber destruction spreads rapidly. Treatment with CHROMATED ZINC CHLORIDE will extend the life of mine ties and timbering from three to ten times dependent upon the condition of use. Many million cubic feet of zinc chloride treatment are already in mine service.

Mill construction, particularly paper and textile plants operating under high humidities suffer early losses due to rapid timber decay. The life of mill roofs normally limited to a scant six or seven years may be extended to more than twenty years by the use of CHROMATED ZINC CHLORIDE treated lumber.

Maintenance costs always exceed the initial investment when early repairs are necessary. Labor and loss of operations exceed the timber cost at an average mill. In a mine, the cost of making a replacement coupled with main haulageway interruptions is several times the intrinsic value of the tie or timber involved.

Relatively the same relationship applies to all forms of wooden construction. Any need for wood subject to premature destruction can employ CHROMATED ZINC CHLORIDE treatment advantageously. It will accomplish the dual purpose of monetary saving to the user and perpetuation of a rapidly depleting timber supply.

A Few of the Many Uses Suited to Chromated Zinc Chloride Treated Lumber:

CHROMATED ZINC CHLORIDE should be used for every purpose employing zinc chloride or other salt-treating reagents in the past. It will further improve the splendid service present zinc chloride installations are exhibiting. A few selected at random and a review of the purposes warranting treatment follow:

Railroads

The life of ties, car lumber, depot and warehouse joists, beams and lumber, section houses, signs, trestle superstructures, posts and many other construction items has been successfully lengthened by the use of zinc chloride treatment.

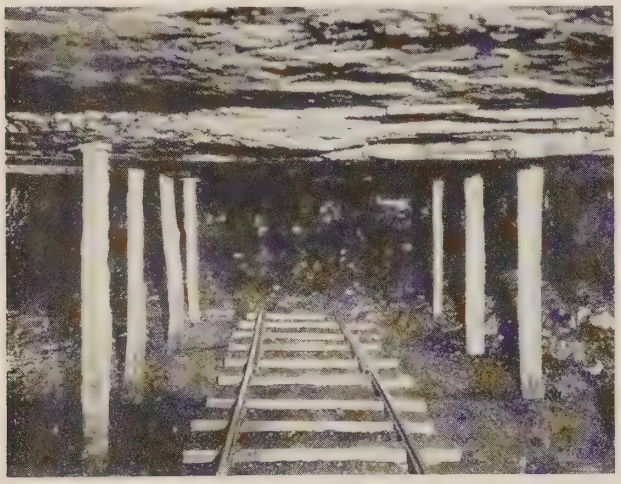
Zinc Chloride treated pine tie cut at rail base. Inspected after 22 years' service.

ZINC CHLORIDE TREATED LUMBER IN ROOF OF RAILWAY SHOP

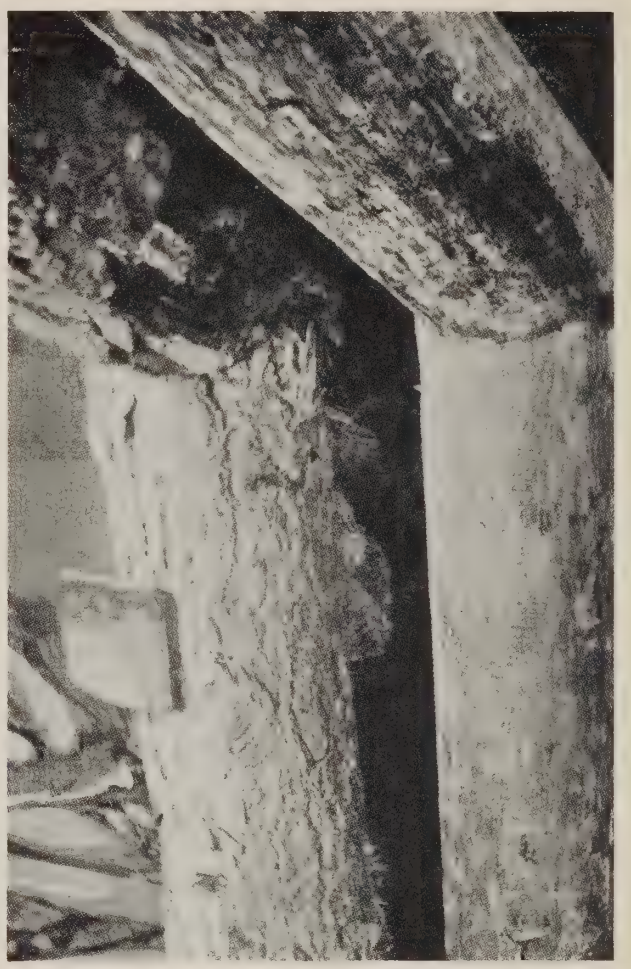
This roof required 932,000 bd. ft. of treated lumber.

Mines

Mine tie and timber requirements are particularly adapted to zinc chloride or CHROMATED ZINC CHLORIDE treatment. The absence of odor capable of destroying the warning accompanying accumulating gases, freedom from health hazards and the fire repellence imparted are sought for properties. Records of service already established show zinc chloride treated installations to outlive from three to ten untreated ties and timbers. Cribbing, lagging, shaft timbers, air course timbers and other underground installations requiring long life, similarly, construction above ground will benefit by treatment.



3″ x 5″ x 5½ ft. ZINC CHLORIDE TREATED MINE TIES.
Approximately 10 years old. Now in re-use fourth time. Ties moved sideways upon re-use to spike in new timber. After four cycles tie is turned over and the same practice repeated.



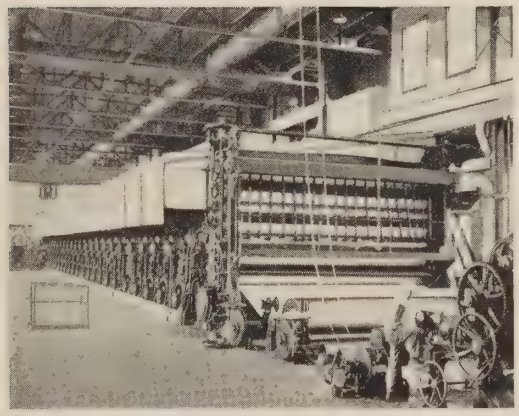
★Treated timber (right, treated with Zinc Chloride), sound after 14 years' service in anthracite mine, compared with untreated timber (at left), which failed after 18 months.

TEXTILE MILL ROOF
Typical construction for Zinc Chloride preserved lumber for low maintenance and long service life.

Industrial Construction

Mill roofs, floors, subfloors, sleepers, and construction beams of every description are improved by treatment. Decay and termite resistance as well as fire retardance and improved surface hardness warrant preservation for safety and low maintenance expense.

★ Courtesy of Service Bureau, American Wood Preservers' Association.



Roof Timbers treated with Zinc Chloride.

View showing first course of concrete placed between the treated wood sleepers, a subsequent course of concrete mortar to be placed later and brought flush with the tops of the sleepers.

Marine Structures

Salt treatment of any description is not recommended for use in water. Dock superstructures requiring paintability, the absence of odors or poisons that may contaminate foodstuffs temporarily stored, and where added fire protection is necessary, warrant the use of CHROMATED ZINC CHLORIDE.

Tower trestle, turntable trestle and turntable, and cable road constructed of Zinc Chloride Treated Timber.

New Pier of Canadian National Steamship Company in Vancouver Harbor, put into operation in June, 1931. About 2,750,000 bd. ft. of timber for stringers, caps and decking were treated with Zinc Chloride.

Highways

Among the many successful uses zinc chloride has enjoyed in the highway industry are included, the treatment of guardrails, guardrail posts, bridge decking and superstructures, handrails and many others.

A Highway Guardrail That Guards.

Treated with Zinc Chloride and painted white these guardrails are permanent and pleasing in appearance.

Zinc Chloride treated guardrail posts.

Guardrails treated with Zinc Chloride and painted white.

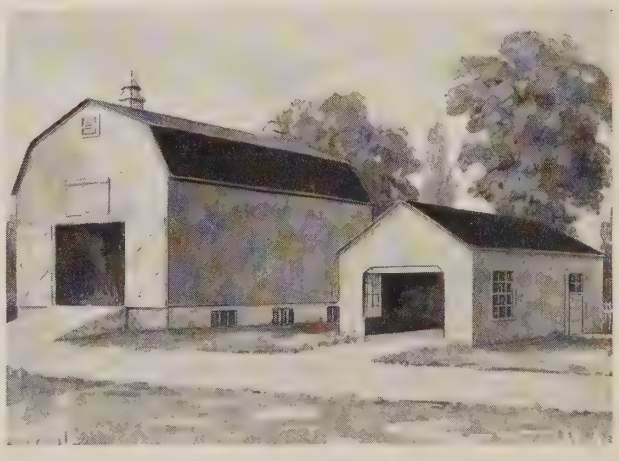
Commercial Buildings

Costly metals and attractive facings of store fronts are no more permanent than their fastenings. Wood backing and supporting members should consist of well treated lumber.

CHROMATED ZINC CHLORIDE treated lumber furnishes long life to supporting members of modern store fronts.

Farm Buildings

The uses of treated lumber on a farm are manifold. It is warranted for barns, poultry houses, stock pens, silos, hog houses, cattle cribs, corn cribs, dairy barns, sheds, gates, posts and fences as well as the farm home.

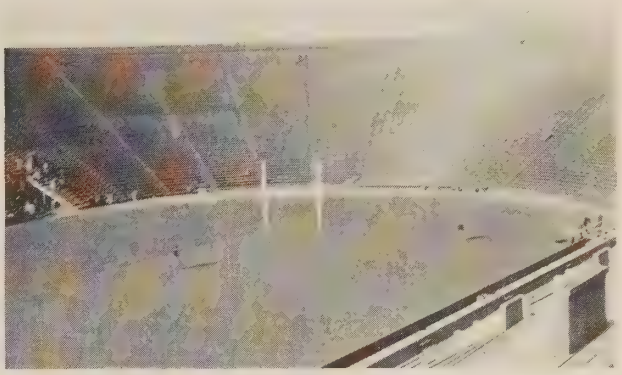


CHROMATED ZINC CHLORIDE treated lumber materially increases the life of farm buildings.

Recreational Structures

Many such forms of construction protected by zinc chloride treatment are in service. They include board walks, stadiums, stadium-seats, pavilions, pleasure devices and shelter houses.

(Right) Harvard Stadium, 180,000 bd. ft., 1 lb. Zinc Chloride per cu. ft. Steps, runways, risers, foot boards, windbreakers, treated with Zinc Chloride.



Roller Coaster treated with Zinc Chloride.

Pleasure resort at Winwood Beach.

Treatment for the Home

The drawing on page 22, illustrates vulnerable sections of a typical home where damage from decay and termites speedily occur. The use of CHROMATED ZINC CHLORIDE treated lumber at these points is cheap protection against premature damage and costly replacements. It will be observed that sills, joists, sub-floors, sash, outside steps and porch materials are particularly vulnerable and impose early maintenance expense. Treated lumber is warranted and should be demanded for these points. It will enhance the value of the property and safeguard the investment.

Fences and fence posts will retain their soundness and good appearance if treated lumber is used.

Lawn furniture, arbors, garages and other uses about the home will be amply protected and assured of long life by the use of CHROMATED ZINC CHLORIDE treated lumber.

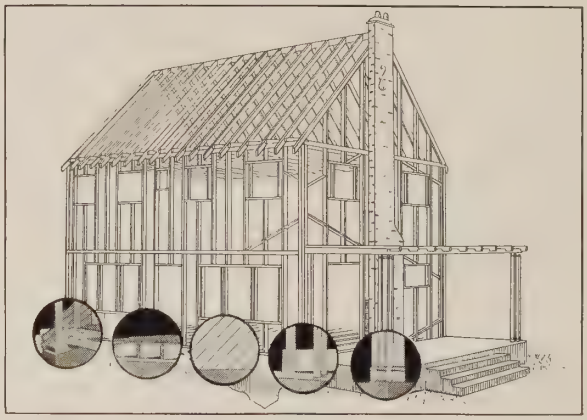
This attractive fence erected with Zinc Chloride treated lumber.

Zinc Chloride treated lumber in Barksdale Field Residence.

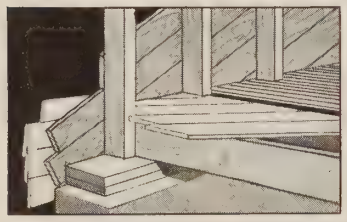
Close-up, showing good job of paint on Zinc Chloride treated door and window frames.

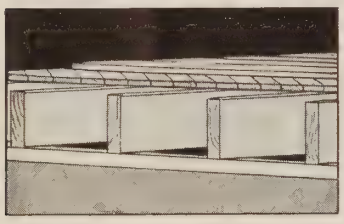
Obviously all wood entering a home is not subject to early decay or termite attack and treatment need only be employed in limited places. The excellent fire resistance of Chromated Zinc Chloride treated lumber also make it very useful where these properties are desired.

Architects should specify Chromated Zinc Chloride treated lumber for use at these vulnerable points. It will assure a long service life of the structure.

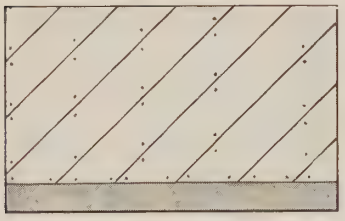


Protection at these points is the sign of a home well built. CHROMATED ZINC CHLORIDE treatment used for sills, headers, soles, studs, joists, sheathing and sub-flooring will assure indefinite freedom from costly repairs. Mill work including door and window frames, exterior trim and many other miscellaneous items also warrant treatment.

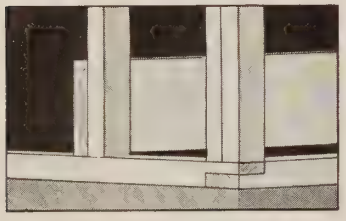




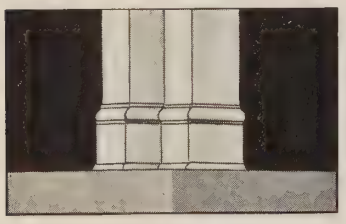
CHROMATED ZINC CHLORIDE treated sub-flooring resting upon treated sills will protect against decay and termite attack, similarly impart measureable fire protection.



Sheathing should be treated for protection against decay resulting from seepage and lack of ventilation; also to repel termites. CHROMATED ZINC CHLORIDE treated sheathing also adds to the fire resistance of the building.

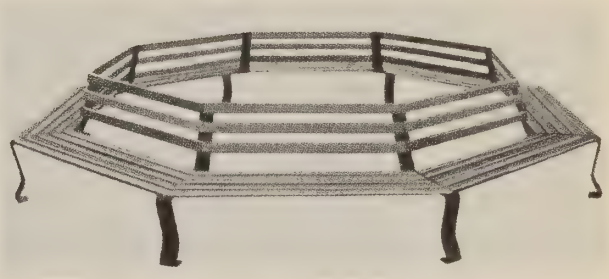


CHROMATED ZINC CHLORIDE treated sills, joists and studs give first assurance of sound and permanent construction.



Porch columns, flooring and supporting members are particularly vulnerable and subject to early decay. CHROMATED ZINC CHLORIDE treated lumber will save costly replacements.

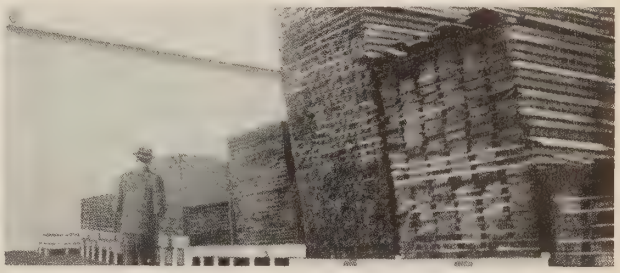
Bench constructed of Zinc Chloride Treated Timber, painted white.



Outdoor Seat constructed of Zinc Chloride Treated Timber, Natural finish.

Zinc Chloride Treated Fence.

Field Officers Quarters, Ft. Knox, Ky.
Zinc Chloride gives permanence to Army Post Buildings.



Clean Zinc Chloride Pressure-Treated Lumber in Stock in Retail Yard.

An example of waste that could have been prevented by Preservative Treatment. Had the original steps been built of CHROMATED Zinc Chloride Pressure-Treated Lumber they would have had a much longer life, and they could have been repainted instead of replaced.

ZINC CHLORIDE TREATED ORNAMENTAL LATTICE, PAINTED

Lattice panels in office of Treating Plant of the Atchison, Topeka & Santa Fe Railway Company, Somerville, Texas, treated with Zinc Chloride and painted white. It has been painted each time the building was painted and holds the paint just as satisfactorily as the untreated weather boarding. This record is of especial interest at this time because of the growing demand for treated timber for numerous purposes where painting as well as protection from decay and termites is desired.

SPECIFICATIONS

Standard Specifications for the Preservative Treatment of Timber and Lumber by Pressure Processes with Chromated Zinc Chloride

Conditioning

Timber shall be conditioned for treatment in accordance with American Wood Preservers' Association "Standards for the Purchase and Preservation of Treatable Timber."

Seasoning

(a) Timber shall be seasoned by air or steam as agreed upon, until in the judgment of the purchaser's representative any moisture in the wood will not prevent the injection and proper distribution of the specified amount of preservative.

(b) When, in the judgment of the purchaser's representative, steam-seasoning is necessary for adequate treatment, timbers may be steamed in the cylinder at not more than 30 lbs. pressure per square inch for not more than 20 hours at not more than 274 degrees F., which pressure and temperature maxima shall not be reached in less than two hours. The cylinder shall be provided with vents to relieve it of air and insure proper circulation of steam. After steaming is completed a minimum vacuum of 22 inches shall be maintained for not less than 15 minutes. The cylinder shall be relieved continuously or frequently enough to prevent condensate from accumulating in sufficient quantity to reach the wood. Before the preservative is introduced the cylinder shall be drained of condensate.

Preparation for Treatment

Any charge of timber shall be confined to one kind or designated group or kinds of wood, of pieces approximately equal in size and moisture and sapwood content, into which approximately equal quantities of preservative can be injected, on which all necessary framing, boring, or chamfering shall have been done, where possible, and so separated as to insure contact of preservative, and steam if used, with all surfaces.

Manner of Treatment

The ranges of pressure, temperature, and time duration shall be controlled so as to result in maximum penetration by the quantity of preservative injected, which shall permeate all of the sapwood, and as much of the heartwood as practicable. The vacuum requirements stipulated are those at sea-level, and necessary corrections shall be made for altitude.

Retention of Preservative

No charge shall contain less than 90%, nor more than 110%, of the quantity of preservative that may be specified; but the average retention of preservative by the material treated under any contract or orders shall be at least 100% of the quantity specified. The amount of preservative retained shall be calculated on the basis of preservative at 100 degrees F., from readings of working tank gauges or scales, or from weights before and after treatment of loaded trams on suitable track scales, checked as may be desired by the purchaser's representative.

Plant Equipment

Treating plants shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages of treatment, and all equipment shall be maintained in condition satisfactory to the purchaser. The apparatus and chemicals necessary for making the analyses and tests required by the purchaser shall also be provided by plant operators, and kept in condition for use at all times.

Determination of Penetration

Penetration shall be determined by sampling timbers in each charge, as may be desired by the purchaser's representative. Any holes which may be bored shall be filled with tight-fitting treated plugs.

PRESERVATIVE

Chromated Zinc Chloride

For general construction, except in water, not less than ¾ lb. of dry salt per cubic foot of timber.

Treating Operation

The treating solution which shall not have a strength exceeding 5%, determined by the American Wood Preservers' Association "Standard Method of Analysis for Zinc Chloride", and which shall be no stronger than necessary to obtain the required retention of preservative with the largest volumetric absorption practicable, shall be thoroughly mixed before use.

Air-seasoned timber may be steamed in the cylinder for not less than one hour, nor more than two hours, at a pressure of not more than 20 lbs. per square inch. After steaming is completed a vacuum of at least 22 inches shall be maintained for not less than 15 minutes, or until the wood is as dry and free of air as practicable. If the vacuum is broken while the condensate is being drained from the cylinder a second vacuum as high as the first shall be created. The preservative shall be introduced without breaking the vacuum until the cylinder is filled. The pressure shall then be raised to and maintained at a minimum of 100 lbs. per square inch until the quantity of preservation to insure the final retention stipulated is injected into the timber, or until less than 5% of the total quantity required has been injected during the latter half of one hour throughout which the rate of injection has persistently decreased while the pressure has been held continuously at 125 or more pounds per square inch. The temperature of the preservative during the pressure period shall be not less than 140 degrees F., nor more than 200 degrees F., and shall average at least 150 degrees F. After the pressure is completed the cylinder shall be emptied speedily of preservative and a vacuum promptly created and maintained until the wood can be removed from the cylinder free of dripping preservative.

MISCELLANEOUS

Virtually every form of lumber and timber construction involves some service requirement warranting the use of treated lumber. Billboards, ventilators, the many varied home and commercial requirements offer an ever increasing opportunity to benefit by the development of wood preservation practice.

Engineers, architects and those contemplating building construction are invited to present their specific problems dealing with wood preservation. Co-operative service will be gladly rendered.

FOUNDED 1839
GRASSELLI
REG. U.S. PAT. OFF.

DU PONT
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.

GRASSELLI CHEMICALS DEPARTMENT

Wilmington, Delaware

629 Euclid Avenue
CLEVELAND, OHIO

NEW YORK OFFICE
350 Fifth Avenue

NEW YORK EXPORT OFFICE
350 Fifth Avenue

Branch Offices and Warehouses

BIRMINGHAM, ALA.	South Bessemer Rd.
BOSTON, MASS.	140 Federal St.
CHARLOTTE, N. C.	414 S. Church St.
CHICAGO, ILL.	2101 Canalport Ave.
CINCINNATI, OHIO	305 Walnut St.
DETROIT, MICH.	1530 E. Hancock Ave.
LOS ANGELES, CAL.	2260 E. 15th St.
MILWAUKEE, WIS.	1503 West Canal St.
NEW HAVEN, CONN.	46 River St.
NEW ORLEANS, LA.	2431 Clio St.
PHILADELPHIA, PA.	3500 Gray's Ferry Ave.
PITTSBURGH, PA.	107 Sixth St.
RENSSELAER, N. Y.	34 Riverside Ave.
SAN FRANCISCO, CAL.	584 Mission St.
ST. LOUIS, MO.	116 W. Ferry St.
ST. PAUL, MINN.	2303 Hampden Ave.

THE WOOD PRESERVING CORPORATION
CENTURY DIVISION
90 BROAD STREET
NEW YORK, N. Y.

Printed in U. S. A.

AVERY LIBRARY
COLUMBIA UNIVERSITY